



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 15, 2024 – 04:10 AM EST

PDB ID : 3OVS
Title : How the CCA-adding Enzyme Selects Adenine over Cytosine in Position 76 of tRNA
Authors : Pan, B.C.; Xiong, Y.; Steitz, T.A.
Deposited on : 2010-09-17
Resolution : 2.80 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

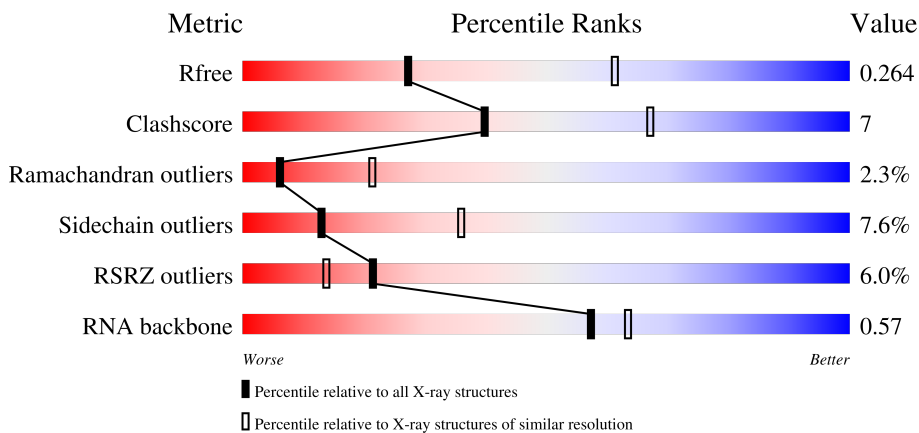
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)
RNA backbone	3102	1227 (3.10-2.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	441	 74% 22% . .
1	B	441	 8% 77% 20% . .
2	C	34	 12% 59% 32% 6% .
2	D	34	 32% 62% 26% 9% .

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 8922 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called CCA-Adding Enzyme.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	441	Total 3656	C 2349	N 636	O 655	S 16	0	0	0
1	B	437	Total 3629	C 2333	N 632	O 651	S 13	0	0	0

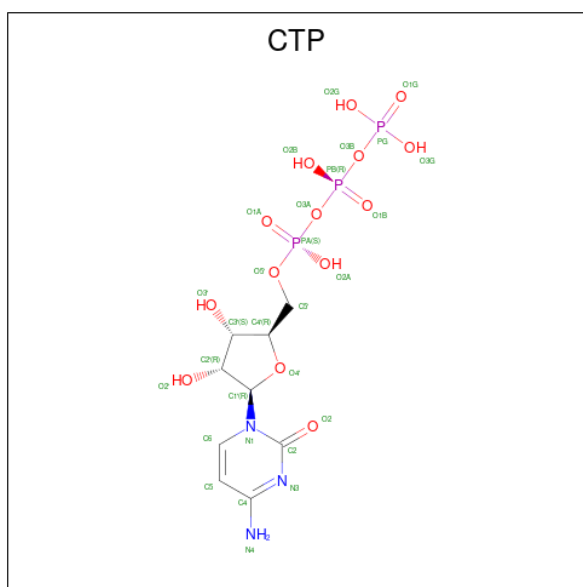
There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	438	VAL	-	expression tag	UNP O28126
A	439	CYS	-	expression tag	UNP O28126
A	440	CYS	-	expression tag	UNP O28126
A	441	MET	-	expression tag	UNP O28126
B	438	VAL	-	expression tag	UNP O28126
B	439	CYS	-	expression tag	UNP O28126
B	440	CYS	-	expression tag	UNP O28126
B	441	MET	-	expression tag	UNP O28126

- Molecule 2 is a RNA chain called RNA (34-MER).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	C	34	Total 720	C 322	N 124	O 240	P 34	3	0	0
2	D	34	Total 720	C 322	N 124	O 240	P 34	3	0	0

- Molecule 3 is CYTIDINE-5'-TRIPHOSPHATE (three-letter code: CTP) (formula: $C_9H_{16}N_3O_{14}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
3	A	1	29	9	3	14	3	0	0
3	B	1	29	9	3	14	3	0	0

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



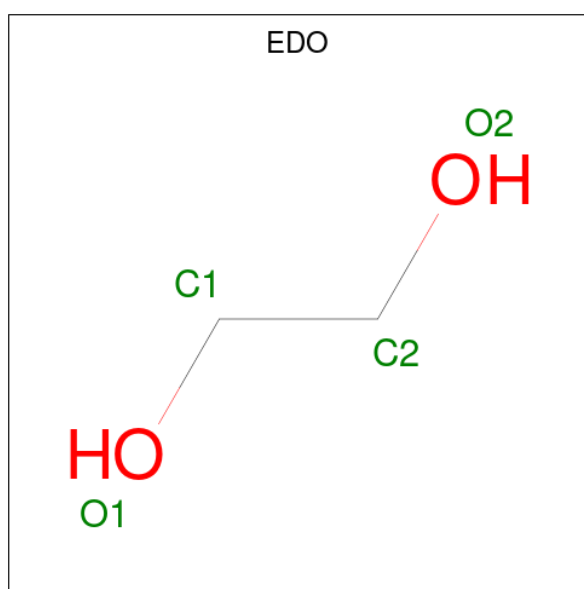
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
4	A	1	5	4	1	0	0
4	A	1	5	4	1	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total O S 5 4 1	0	0
4	A	1	Total O S 5 4 1	0	0
4	A	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C₂H₆O₂).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	B	1	Total C O 4 2 2	0	0

- Molecule 6 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total Ca 1 1	0	0

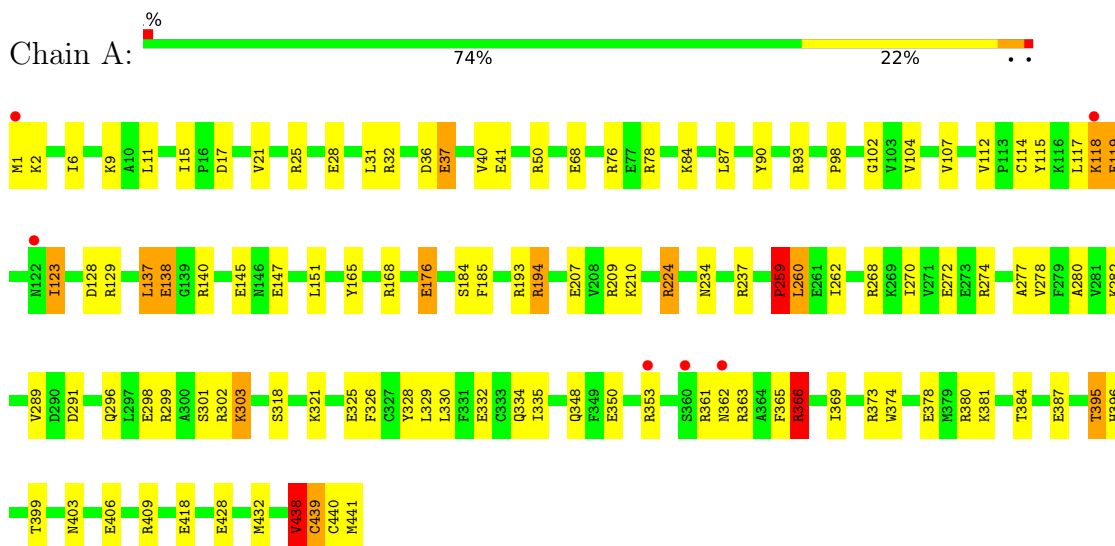
- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	67	Total O 67 67	0	0
7	B	24	Total O 24 24	0	0
7	C	3	Total O 3 3	0	0
7	D	2	Total O 2 2	0	0

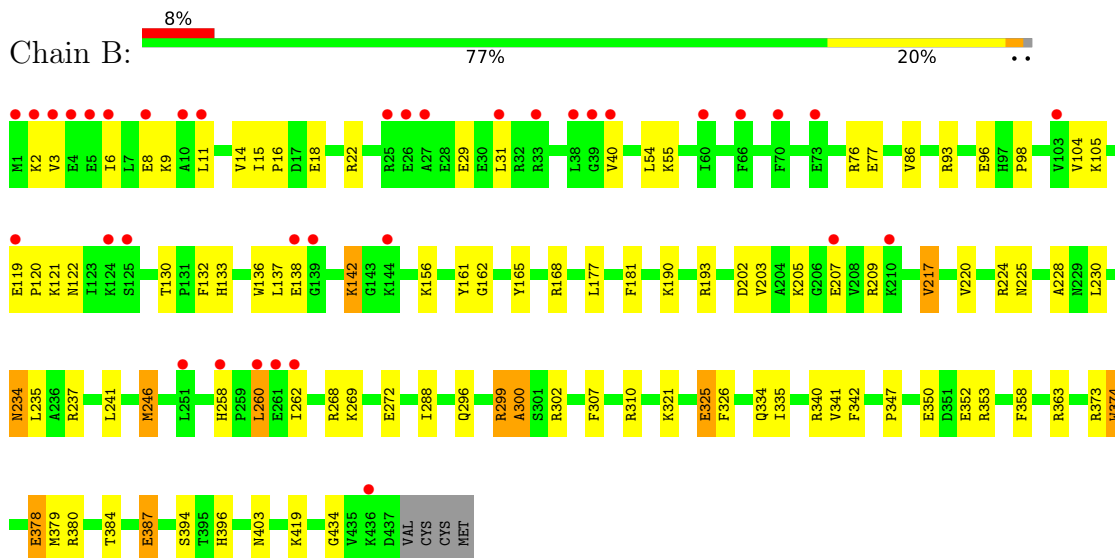
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: CCA-Adding Enzyme

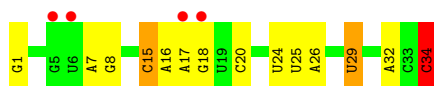


- Molecule 1: CCA-Adding Enzyme

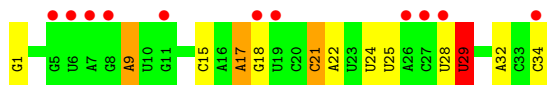


- Molecule 2: RNA (34-MER)





- Molecule 2: RNA (34-MER)



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	111.31Å 218.22Å 58.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.80 – 2.80 37.79 – 2.80	Depositor EDS
% Data completeness (in resolution range)	100.0 (37.80-2.80) 97.9 (37.79-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.14	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.46 (at 2.81Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.211 , 0.268 0.209 , 0.264	Depositor DCC
R_{free} test set	1767 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	51.0	Xtrriage
Anisotropy	0.093	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 60.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	8922	wwPDB-VP
Average B, all atoms (Å ²)	61.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.04% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality i

5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: CTP, CA, EDO, SO4

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.50	0/3739	0.64	2/5023 (0.0%)
1	B	0.61	3/3712 (0.1%)	0.60	1/4987 (0.0%)
2	C	0.92	1/803 (0.1%)	1.36	8/1246 (0.6%)
2	D	1.17	2/803 (0.2%)	1.60	8/1246 (0.6%)
All	All	0.67	6/9057 (0.1%)	0.86	19/12502 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	2

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	8	GLU	CD-OE2	21.98	1.49	1.25
2	D	1	G	P-O5'	-19.20	1.40	1.59
2	D	1	G	OP3-P	18.23	1.83	1.61
2	C	1	G	OP3-P	15.49	1.79	1.61
1	B	8	GLU	CD-OE1	11.34	1.38	1.25
1	B	387	GLU	CG-CD	5.61	1.60	1.51

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	G	P-O5'-C5'	29.14	167.53	120.90
2	D	1	G	O5'-P-OP2	-15.84	91.44	105.70
2	C	15	C	O4'-C1'-N1	7.11	113.89	108.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1	G	P-O5'-C5'	6.88	131.91	120.90
1	B	8	GLU	OE1-CD-OE2	6.87	131.55	123.30
2	C	34	C	O4'-C1'-N1	6.71	113.57	108.20
1	A	438	VAL	N-CA-C	5.95	127.06	111.00
2	D	29	U	O4'-C1'-N1	5.87	112.90	108.20
2	D	21	C	N1-C2-O2	5.86	122.42	118.90
2	C	1	G	N1-C6-O6	-5.82	116.41	119.90
2	D	15	C	N3-C2-O2	-5.73	117.89	121.90
2	C	34	C	C3'-C2'-C1'	5.56	105.95	101.50
1	A	438	VAL	C-N-CA	5.53	135.53	121.70
2	C	29	U	C5'-C4'-C3'	-5.46	107.27	116.00
2	D	15	C	N1-C2-O2	5.22	122.03	118.90
2	D	15	C	O4'-C1'-N1	5.21	112.36	108.20
2	C	26	A	O4'-C1'-N9	5.09	112.27	108.20
2	D	17	A	P-O3'-C3'	5.06	125.77	119.70
2	C	7	A	O4'-C1'-N9	5.02	112.22	108.20

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	299	ARG	Peptide
1	B	373	ARG	Peptide

5.2 Too-close contacts [\(i\)](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3656	0	3661	73	0
1	B	3629	0	3633	51	0
2	C	720	0	365	4	0
2	D	720	0	365	5	0
3	A	29	0	12	0	0
3	B	29	0	12	0	0
4	A	25	0	0	2	0
4	B	5	0	0	0	0
5	A	8	0	12	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	B	4	0	6	0	0
6	A	1	0	0	0	0
7	A	67	0	0	3	0
7	B	24	0	0	2	0
7	C	3	0	0	0	0
7	D	2	0	0	0	0
All	All	8922	0	8066	123	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 7.

All (123) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:395:THR:HG23	1:A:396:HIS:CD2	1.85	1.11
1:A:406:GLU:HG2	1:A:409:ARG:HH12	1.25	1.00
1:A:395:THR:CG2	1:A:396:HIS:HD2	1.75	1.00
1:A:365:PHE:O	1:A:366:ARG:HB2	1.63	0.96
1:A:380:ARG:HH22	1:B:334:GLN:HE22	1.23	0.87
1:A:395:THR:CG2	1:A:396:HIS:CD2	2.55	0.87
1:A:334:GLN:HE22	1:B:380:ARG:HH22	1.28	0.81
1:A:140:ARG:HD3	5:A:701:EDO:H21	1.67	0.75
1:B:378:GLU:HG3	7:B:453:HOH:O	1.87	0.74
1:A:76:ARG:HB3	1:A:98:PRO:HG3	1.69	0.72
1:A:296:GLN:HE22	1:A:403:ASN:HD22	1.34	0.72
1:A:280:ALA:HB2	1:A:330:LEU:HD23	1.71	0.72
1:A:365:PHE:O	1:A:366:ARG:CB	2.35	0.71
1:B:230:LEU:HD21	1:B:235:LEU:HB2	1.73	0.69
1:B:299:ARG:N	1:B:300:ALA:HB3	2.09	0.68
1:A:334:GLN:NE2	1:B:380:ARG:HH22	1.92	0.67
1:B:136:TRP:HE3	1:B:137:LEU:HD12	1.60	0.66
1:A:438:VAL:H	1:A:439:CYS:HB2	1.61	0.64
1:A:365:PHE:O	1:B:434:GLY:O	2.15	0.64
1:B:132:PHE:HB3	1:B:220:VAL:HG11	1.79	0.62
1:A:384:THR:OG1	1:A:387:GLU:HG3	1.99	0.62
1:B:168:ARG:HD2	7:B:445:HOH:O	2.00	0.61
1:B:384:THR:OG1	1:B:387:GLU:HB2	2.00	0.61
1:B:11:LEU:HA	1:B:14:VAL:HG22	1.82	0.61
1:A:36:ASP:O	1:A:37:GLU:HB3	2.01	0.61
1:A:325:GLU:HG2	1:A:326:PHE:CD1	2.36	0.60
1:B:299:ARG:O	1:B:302:ARG:HB3	2.01	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:348:GLN:HE21	1:A:373:ARG:NH1	1.99	0.60
1:B:190:LYS:HG2	1:B:246:MET:SD	2.42	0.59
1:A:380:ARG:HH22	1:B:334:GLN:NE2	1.98	0.59
1:A:270:ILE:O	1:A:274:ARG:HG3	2.03	0.58
1:B:234:ASN:ND2	1:B:237:ARG:HH11	2.01	0.58
1:A:406:GLU:CG	1:A:409:ARG:HH12	2.07	0.58
1:B:181:PHE:HD1	1:B:203:VAL:HA	1.70	0.57
1:A:278:VAL:HG22	1:A:332:GLU:HG3	1.87	0.56
1:B:181:PHE:CD1	1:B:203:VAL:HA	2.41	0.56
1:B:296:GLN:O	1:B:300:ALA:HB2	2.06	0.56
1:B:296:GLN:O	1:B:300:ALA:CB	2.54	0.56
1:A:299:ARG:NH1	1:A:399:THR:O	2.34	0.54
1:A:395:THR:HG22	1:A:396:HIS:HD2	1.64	0.54
2:D:24:U:H2'	2:D:25:U:C6	2.42	0.54
1:B:296:GLN:HE22	1:B:403:ASN:ND2	2.05	0.54
1:A:335:ILE:HD12	1:B:335:ILE:HD12	1.90	0.54
1:A:438:VAL:HG12	1:A:439:CYS:SG	2.48	0.54
1:A:84:LYS:HG2	1:A:90:TYR:CZ	2.43	0.53
1:A:440:CYS:SG	1:A:441:MET:N	2.81	0.53
1:B:358:PHE:O	1:B:363:ARG:NH2	2.38	0.53
1:B:225:ASN:HB3	1:B:228:ALA:HB2	1.90	0.53
1:B:341:VAL:HG12	1:B:379:MET:SD	2.49	0.53
1:B:342:PHE:CZ	1:B:378:GLU:HB3	2.44	0.53
1:A:50:ARG:HD2	1:A:176:GLU:OE2	2.08	0.52
1:A:438:VAL:N	1:A:439:CYS:HB2	2.24	0.52
1:A:147:GLU:HG3	1:A:185:PHE:H	1.74	0.52
1:A:17:ASP:O	1:A:21:VAL:HG23	2.10	0.52
1:A:260:LEU:HB2	1:A:439:CYS:H	1.74	0.52
1:A:348:GLN:HE21	1:A:373:ARG:HH12	1.58	0.51
1:A:369:ILE:HD11	1:A:374:TRP:CZ2	2.46	0.51
1:A:302:ARG:NH1	7:A:488:HOH:O	2.44	0.51
1:A:41:GLU:HB2	4:A:603:SO4:O3	2.12	0.50
1:A:1:MET:HG3	1:A:6:ILE:HD11	1.93	0.50
1:A:68:GLU:HA	1:A:115:TYR:CD2	2.46	0.50
1:A:31:LEU:HD13	1:A:104:VAL:HG21	1.94	0.49
1:A:234:ASN:HD22	1:A:237:ARG:HH11	1.60	0.49
2:D:28:U:H2'	2:D:29:U:C6	2.46	0.49
1:A:129:ARG:CZ	1:A:224:ARG:HG3	2.42	0.49
1:B:31:LEU:HD13	1:B:104:VAL:HG21	1.94	0.49
1:B:76:ARG:HB3	1:B:98:PRO:HG3	1.95	0.49
1:A:36:ASP:O	1:A:37:GLU:CB	2.59	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:140:ARG:HD3	5:A:701:EDO:C2	2.42	0.48
1:B:268:ARG:NH1	1:B:272:GLU:OE1	2.46	0.48
1:A:296:GLN:HE22	1:A:403:ASN:ND2	2.07	0.48
1:B:342:PHE:CE2	1:B:378:GLU:HB3	2.49	0.47
1:B:193:ARG:HD2	1:B:246:MET:HG3	1.97	0.47
1:A:280:ALA:HA	1:A:329:LEU:O	2.15	0.46
1:B:76:ARG:NH2	1:B:77:GLU:OE1	2.49	0.46
1:A:118:LYS:O	1:A:119:GLU:HB2	2.16	0.46
1:A:325:GLU:OE1	1:A:325:GLU:N	2.47	0.46
1:B:307:PHE:HA	1:B:310:ARG:NH1	2.30	0.45
2:C:15:C:H2'	2:C:16:A:O4'	2.16	0.45
1:B:138:GLU:O	1:B:142:LYS:HD3	2.16	0.45
1:A:207:GLU:OE1	1:A:209:ARG:HD3	2.17	0.45
1:B:207:GLU:HB3	1:B:209:ARG:HH11	1.81	0.44
2:D:9:A:OP2	2:D:9:A:H8	1.99	0.44
1:A:112:VAL:HG21	2:C:34:C:H4'	1.99	0.44
1:B:347:PRO:O	1:B:374:TRP:HB2	2.17	0.44
1:A:87:LEU:HD13	1:A:102:GLY:HA3	2.00	0.44
1:B:202:ASP:HA	1:B:217:VAL:HG13	1.98	0.44
1:A:259:PRO:O	1:A:438:VAL:O	2.36	0.44
1:A:50:ARG:NH2	7:A:508:HOH:O	2.51	0.44
1:A:123:ILE:HD12	1:A:128:ASP:HB2	1.99	0.44
1:B:6:ILE:HA	1:B:9:LYS:HE2	1.99	0.44
1:B:54:LEU:HD22	1:B:156:LYS:HD3	2.00	0.44
1:B:234:ASN:HD22	1:B:237:ARG:HH11	1.66	0.44
1:A:165:TYR:CE1	2:C:32:A:H1'	2.54	0.43
1:B:121:LYS:O	1:B:122:ASN:HB2	2.19	0.43
1:A:440:CYS:SG	1:A:441:MET:CE	3.07	0.43
1:A:11:LEU:HB3	1:A:15:ILE:HD12	2.01	0.43
1:B:130:THR:O	1:B:133:HIS:HB2	2.18	0.43
1:B:18:GLU:O	1:B:22:ARG:HB2	2.19	0.43
1:A:428:GLU:O	1:A:432:MET:HB2	2.19	0.42
1:A:289:VAL:HG22	4:A:606:SO4:O4	2.19	0.42
1:B:325:GLU:HG2	1:B:326:PHE:CD1	2.54	0.42
1:A:268:ARG:NH1	1:A:272:GLU:OE1	2.53	0.42
1:A:303:LYS:HB3	1:A:303:LYS:HE2	1.89	0.42
1:B:258:HIS:O	1:B:260:LEU:N	2.52	0.42
1:B:396:HIS:HE1	2:D:21:C:O2'	2.02	0.42
1:A:260:LEU:HB3	1:A:438:VAL:O	2.20	0.42
1:A:277:ALA:O	1:A:332:GLU:HA	2.20	0.42
1:A:137:LEU:O	1:A:138:GLU:C	2.58	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:438:VAL:CA	1:A:439:CYS:HB2	2.50	0.42
1:B:234:ASN:HD22	1:B:234:ASN:HA	1.56	0.42
1:A:147:GLU:CG	1:A:184:SER:HA	2.50	0.41
1:A:118:LYS:HD3	1:A:118:LYS:H	1.86	0.41
1:A:282:LYS:HG3	1:A:328:TYR:CE2	2.56	0.41
1:A:93:ARG:HG2	1:A:289:VAL:HG12	2.02	0.41
1:A:194:ARG:NE	7:A:475:HOH:O	2.53	0.41
1:B:15:ILE:HA	1:B:16:PRO:HD3	1.91	0.41
1:B:165:TYR:CE1	2:D:32:A:H1'	2.56	0.41
1:A:28:GLU:O	1:A:32:ARG:HG3	2.21	0.41
1:B:288:ILE:HD13	1:B:403:ASN:HD22	1.86	0.41
1:B:177:LEU:HD22	1:B:203:VAL:HG21	2.03	0.41
1:A:440:CYS:SG	1:A:441:MET:HE2	2.62	0.40
2:C:24:U:H2'	2:C:25:U:C6	2.56	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	439/441 (100%)	408 (93%)	22 (5%)	9 (2%)	7 23
1	B	435/441 (99%)	403 (93%)	21 (5%)	11 (2%)	5 19
All	All	874/882 (99%)	811 (93%)	43 (5%)	20 (2%)	6 21

All (20) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	40	VAL
1	A	350	GLU
1	A	366	ARG
1	A	439	CYS

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Mol	Chain	Res	Type
1	B	40	VAL
1	B	161	TYR
1	A	123	ILE
1	A	138	GLU
1	B	3	VAL
1	B	162	GLY
1	B	300	ALA
1	A	260	LEU
1	A	119	GLU
1	B	55	LYS
1	B	86	VAL
1	B	374	TRP
1	B	119	GLU
1	B	260	LEU
1	A	259	PRO
1	B	120	PRO

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	391/391 (100%)	355 (91%)	36 (9%)	9 27
1	B	387/391 (99%)	364 (94%)	23 (6%)	19 49
All	All	778/782 (100%)	719 (92%)	59 (8%)	13 36

All (59) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	LYS
1	A	9	LYS
1	A	25	ARG
1	A	37	GLU
1	A	78	ARG
1	A	107	VAL
1	A	114	CYS

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Mol	Chain	Res	Type
1	A	117	LEU
1	A	118	LYS
1	A	137	LEU
1	A	145	GLU
1	A	151	LEU
1	A	168	ARG
1	A	176	GLU
1	A	193	ARG
1	A	194	ARG
1	A	210	LYS
1	A	224	ARG
1	A	259	PRO
1	A	262	ILE
1	A	291	ASP
1	A	298	GLU
1	A	301	SER
1	A	303	LYS
1	A	318	SER
1	A	321	LYS
1	A	353	ARG
1	A	361	ARG
1	A	362	ASN
1	A	363	ARG
1	A	366	ARG
1	A	378	GLU
1	A	381	LYS
1	A	395	THR
1	A	418	GLU
1	A	438	VAL
1	B	2	LYS
1	B	29	GLU
1	B	93	ARG
1	B	96	GLU
1	B	105	LYS
1	B	142	LYS
1	B	205	LYS
1	B	217	VAL
1	B	224	ARG
1	B	234	ASN
1	B	241	LEU
1	B	246	MET
1	B	262	ILE

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Mol	Chain	Res	Type
1	B	269	LYS
1	B	321	LYS
1	B	325	GLU
1	B	340	ARG
1	B	350	GLU
1	B	352	GLU
1	B	353	ARG
1	B	378	GLU
1	B	394	SER
1	B	419	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	97	HIS
1	A	234	ASN
1	A	312	ASN
1	A	334	GLN
1	A	348	GLN
1	A	396	HIS
1	A	403	ASN
1	B	97	HIS
1	B	146	ASN
1	B	234	ASN
1	B	334	GLN
1	B	354	ASN
1	B	371	ASN
1	B	396	HIS
1	B	403	ASN

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	C	33/34 (97%)	6 (18%)	0
2	D	33/34 (97%)	6 (18%)	1 (3%)
All	All	66/68 (97%)	12 (18%)	1 (1%)

All (12) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
2	C	8	G
2	C	17	A
2	C	18	G
2	C	20	C
2	C	29	U
2	C	34	C
2	D	9	A
2	D	17	A
2	D	18	G
2	D	22	A
2	D	29	U
2	D	34	C

All (1) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
2	D	17	A

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 12 ligands modelled in this entry, 1 is monoatomic - leaving 11 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	SO4	A	604	-	4,4,4	0.19	0	6,6,6	0.41	0
4	SO4	A	606	-	4,4,4	0.17	0	6,6,6	0.19	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	SO4	A	601	-	4,4,4	0.18	0	6,6,6	0.15	0
3	CTP	A	501	6	26,30,30	0.89	2 (7%)	39,47,47	1.20	5 (12%)
4	SO4	B	605	-	4,4,4	0.16	0	6,6,6	0.16	0
5	EDO	A	701	-	3,3,3	0.48	0	2,2,2	0.28	0
4	SO4	A	602	-	4,4,4	0.16	0	6,6,6	0.23	0
5	EDO	A	702	-	3,3,3	0.46	0	2,2,2	0.42	0
3	CTP	B	502	-	26,30,30	0.88	1 (3%)	39,47,47	1.21	3 (7%)
5	EDO	B	703	-	3,3,3	0.48	0	2,2,2	0.33	0
4	SO4	A	603	-	4,4,4	0.17	0	6,6,6	0.29	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	EDO	A	701	-	-	1/1/1/1	-
3	CTP	A	501	6	-	4/22/38/38	0/2/2/2
5	EDO	A	702	-	-	1/1/1/1	-
3	CTP	B	502	-	-	4/22/38/38	0/2/2/2
5	EDO	B	703	-	-	1/1/1/1	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	501	CTP	C4-N3	2.46	1.39	1.34
3	B	502	CTP	C4-N3	2.24	1.39	1.34
3	A	501	CTP	C6-C5	2.01	1.39	1.35

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	502	CTP	PB-O3B-PG	-3.35	121.34	132.83
3	B	502	CTP	PB-O3A-PA	-3.34	121.37	132.83
3	A	501	CTP	O2-C2-N3	-3.00	117.46	122.33
3	A	501	CTP	PB-O3B-PG	-2.73	123.46	132.83
3	A	501	CTP	PB-O3A-PA	-2.71	123.52	132.83
3	B	502	CTP	O2-C2-N3	-2.57	118.15	122.33
3	A	501	CTP	O2G-PG-O3B	2.31	112.38	104.64
3	A	501	CTP	O2-C2-N1	2.02	123.06	118.89

There are no chirality outliers.

All (11) torsion outliers are listed below:

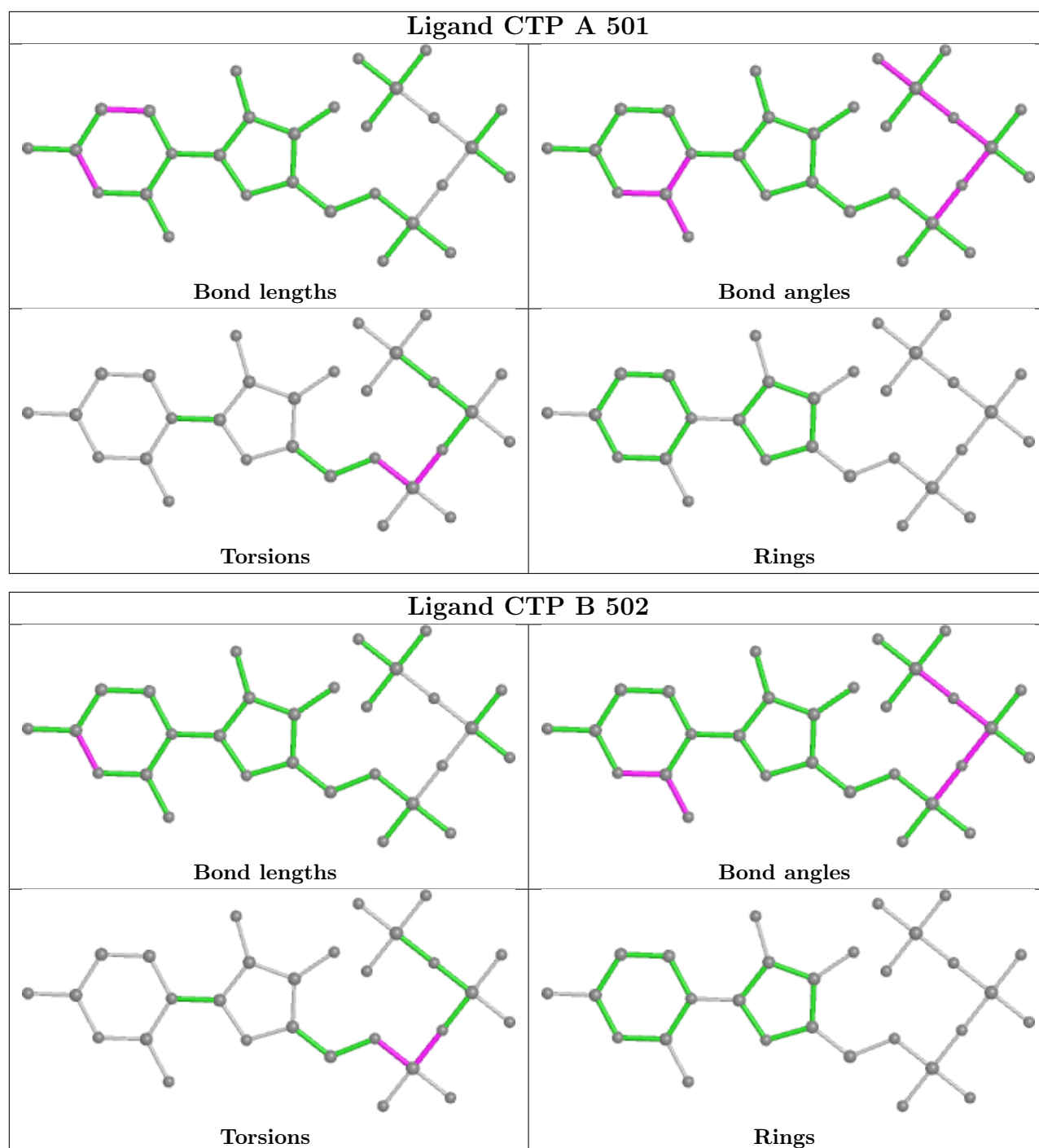
Mol	Chain	Res	Type	Atoms
3	A	501	CTP	PB-O3A-PA-O5'
3	B	502	CTP	C5'-O5'-PA-O1A
3	B	502	CTP	PB-O3A-PA-O5'
5	A	701	EDO	O1-C1-C2-O2
5	A	702	EDO	O1-C1-C2-O2
3	A	501	CTP	C5'-O5'-PA-O3A
3	A	501	CTP	C5'-O5'-PA-O1A
3	A	501	CTP	C5'-O5'-PA-O2A
3	B	502	CTP	C5'-O5'-PA-O2A
5	B	703	EDO	O1-C1-C2-O2
3	B	502	CTP	C5'-O5'-PA-O3A

There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	606	SO4	1	0
5	A	701	EDO	2	0
4	A	603	SO4	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	441/441 (100%)	-0.01	6 (1%) 75 70	22, 36, 66, 115	0
1	B	437/441 (99%)	0.56	36 (8%) 11 6	25, 77, 133, 199	0
2	C	34/34 (100%)	0.70	4 (11%) 4 2	30, 66, 94, 100	1 (2%)
2	D	34/34 (100%)	1.47	11 (32%) 0 0	49, 89, 138, 146	1 (2%)
All	All	946/950 (99%)	0.33	57 (6%) 21 14	22, 46, 125, 199	2 (0%)

All (57) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	261	GLU	7.3
2	D	18	G	6.7
1	B	3	VAL	6.5
1	B	5	GLU	4.8
1	B	251	LEU	4.5
1	B	258	HIS	4.4
1	A	122	ASN	4.4
1	B	33	ARG	4.1
1	B	138	GLU	3.9
2	D	19	U	3.8
1	B	6	ILE	3.8
1	B	139	GLY	3.7
1	B	262	ILE	3.7
1	A	353	ARG	3.6
1	B	31	LEU	3.6
2	C	18	G	3.6
1	A	1	MET	3.6
1	B	8	GLU	3.6
1	B	1	MET	3.5
1	B	39	GLY	3.3
1	B	38	LEU	3.2

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Mol	Chain	Res	Type	RSRZ
2	D	7	A	3.1
2	D	11	G	2.9
2	D	26	A	2.9
2	D	6	U	2.9
1	B	210	LYS	2.8
1	B	260	LEU	2.7
2	D	5	G	2.7
1	B	4	GLU	2.6
1	B	119	GLU	2.6
1	A	360	SER	2.5
1	B	2	LYS	2.5
1	B	436	LYS	2.5
1	B	70	PHE	2.5
1	B	26	GLU	2.4
1	B	27	ALA	2.4
1	B	73	GLU	2.4
1	A	362	ASN	2.4
1	A	118	LYS	2.3
1	B	66	PHE	2.3
1	B	60	ILE	2.3
1	B	124	LYS	2.3
2	D	8	G	2.3
2	D	34	C	2.3
1	B	144	LYS	2.3
1	B	103	VAL	2.3
2	D	27	C	2.2
2	C	6	U	2.2
1	B	10	ALA	2.2
1	B	25	ARG	2.2
1	B	207	GLU	2.2
2	C	5	G	2.1
1	B	11	LEU	2.1
1	B	125	SER	2.1
1	B	40	VAL	2.0
2	C	17	A	2.0
2	D	28	U	2.0

6.2 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

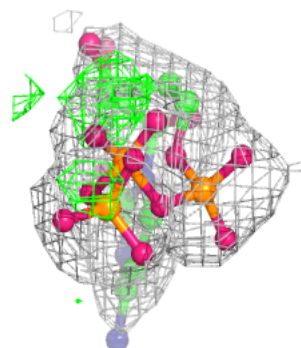
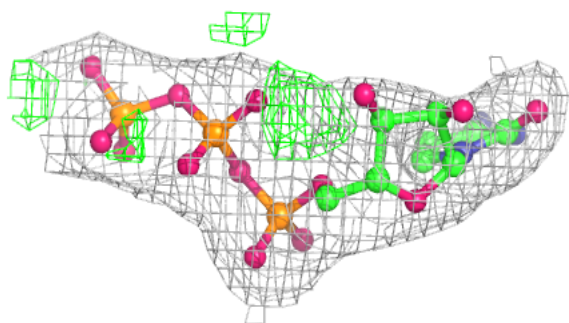
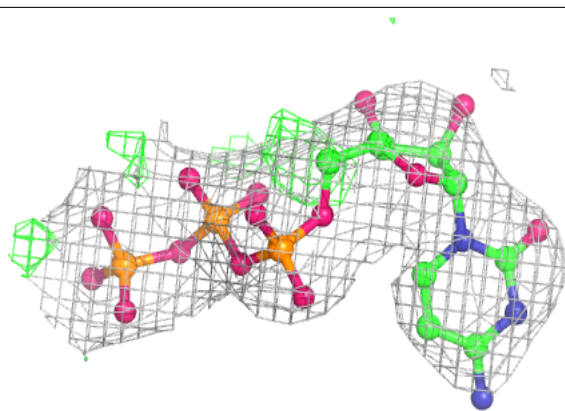
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	EDO	B	703	4/4	0.54	0.28	72,72,73,73	0
6	CA	A	801	1/1	0.84	0.30	40,40,40,40	0
5	EDO	A	702	4/4	0.89	0.19	61,62,62,62	0
4	SO4	A	602	5/5	0.90	0.13	67,68,68,68	0
4	SO4	A	603	5/5	0.91	0.39	90,90,90,91	0
3	CTP	B	502	29/29	0.91	0.32	62,64,67,67	29
4	SO4	A	604	5/5	0.93	0.20	65,65,65,65	0
4	SO4	A	606	5/5	0.94	0.29	81,81,81,81	0
5	EDO	A	701	4/4	0.95	0.17	24,26,27,28	0
4	SO4	B	605	5/5	0.95	0.18	67,67,67,67	0
4	SO4	A	601	5/5	0.96	0.17	64,64,64,65	0
3	CTP	A	501	29/29	0.97	0.15	33,34,38,38	0

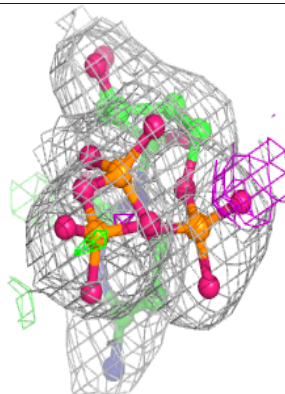
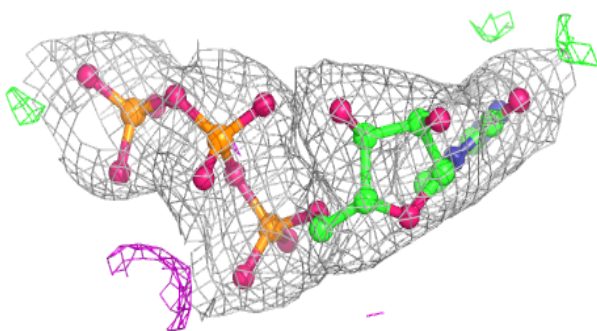
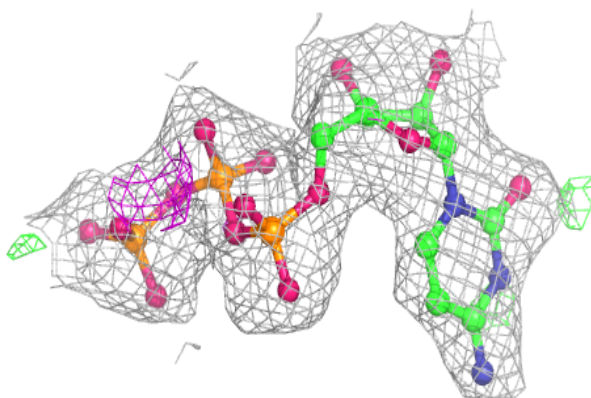
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around CTP B 502:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

**Electron density around CTP A 501:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



6.5 Other polymers [i](#)

There are no such residues in this entry.